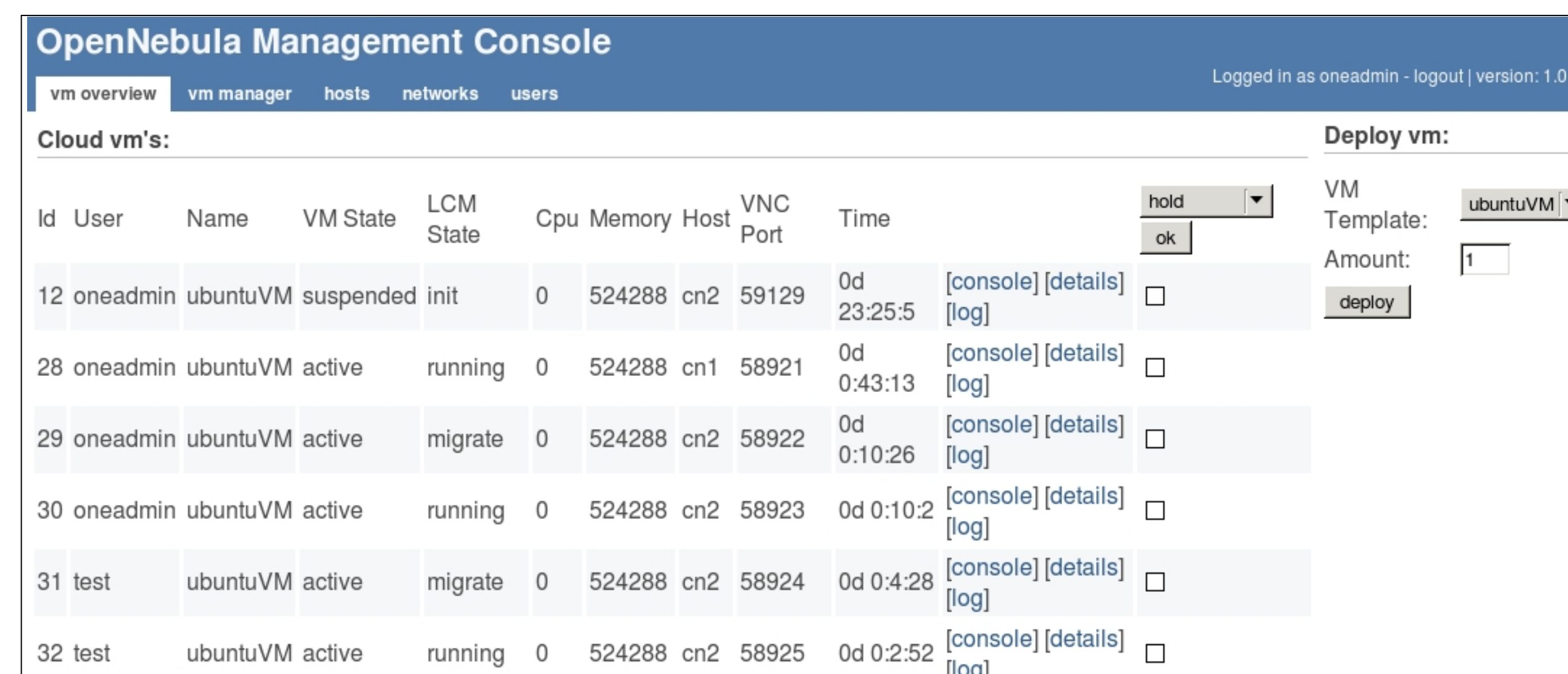# Private cloud technologies

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## Abstract

Faced with a variety of computing resources of differing utilization levels, a private cloud allows organizations to optimize limited computing resources. With rising interest in cloud computing and community support, providing flexible infrastructure through virtualization has become a more feasible solution. In this poster we summarize our implementation of a virtualized private cloud environment using open source technologies like OpenNebula and Kernel-Based Virtual Machines (KVM). OpenNebula provides flexibility through a simple interface used to manage a variety of different virtual technologies to be able to host a dynamic range of applications. Businesses require high availability computing and KVM supports live migration during hardware failures to guarantee uninterrupted service along with Distributed Replicated Block Device (DRBD) for robust storage. For an quantitative evaluation, we compare benchmarks of different workloads on native hardware and on the cloud. For a qualitative evaluation we compared management, availability, and customer experience.

### OpenNebula Management Console

| Id | User | Name | VM State | LCM State | Cpu | Memory | Host | VNC Port | Time | | | |
|----|------|------|----------|-----------|-----|--------|------|----------|------|--|--|--|
| 12 | oneadmin | ubuntuVM | suspended | init | 0 | 524288 | cn2 | 59129 | 0d 23:25:5 | [console] [details] [log] | | |
| 28 | oneadmin | ubuntuVM | active | running | 0 | 524288 | cn1 | 58921 | 0d 0:43:13 | [console] [details] [log] | | |
| 29 | oneadmin | ubuntuVM | active | migrate | 0 | 524288 | cn2 | 58922 | 0d 0:10:26 | [console] [details] [log] | | |
| 30 | oneadmin | ubuntuVM | active | running | 0 | 524288 | cn2 | 58923 | 0d 0:10:2 | [console] [details] [log] | | |
| 31 | test | ubuntuVM | active | migrate | 0 | 524288 | cn2 | 58924 | 0d 0:4:28 | [console] [details] [log] | | |
| 32 | test | ubuntuVM | active | running | 0 | 524288 | cn2 | 58925 | 0d 0:2:52 | [console] [details] [log] | | |

## Management of the Cloud

For the management of our cloud we used the Open Nebula Management Console, this provided a web interface which allows us to not only create accounts with different permissions but deploy, migrate, and suspend virtual hosts, networks and machines. This web interface also allowed us to open a VNC console to view and interact with the virtual instances.

Virtual Machine Manager provided us a GUI interface to our virtual instances and allowed us to monitor CPU usage, Disk I/O, and Network bandwidth usage across all nodes. We were also able to migrate, clone, suspend, pause the instances as well as administer them via VNC.

## Customer Experience

We were unable to bring up an external cloud interface for customers do to time constraints. However, customers working from within the private cloud would likely access the could directly through either the Open Nebula core or the One Management Console. Implementing a hybrid cloud would likely be the best solution because you would gain the public interface and be able to farm out jobs to third party clouds.

## Implementation Challenges

We faced many challenges in getting Open Nebula up and running correctly. With this being fairly new software and cloud computing taking off, there is not much support out there. We faced issues in Cent OS with little documentation, and switched to Ubuntu where we encountered fewer bugs that needed workarounds.

## Performance

We used Linpack benchmark to compare virtual node with native hardware. The virtual node attained 85% of the performance in native hardware.

## Availability and Robustness

We were able to successfully migrate a running virtual instance from one node to another without interruption. For storage we implemented a networked raid storage solution which allowed us to redundantly store both the image repository and the running images. Both of these features allow us to provide uninterrupted service if a physical node were to start failing.
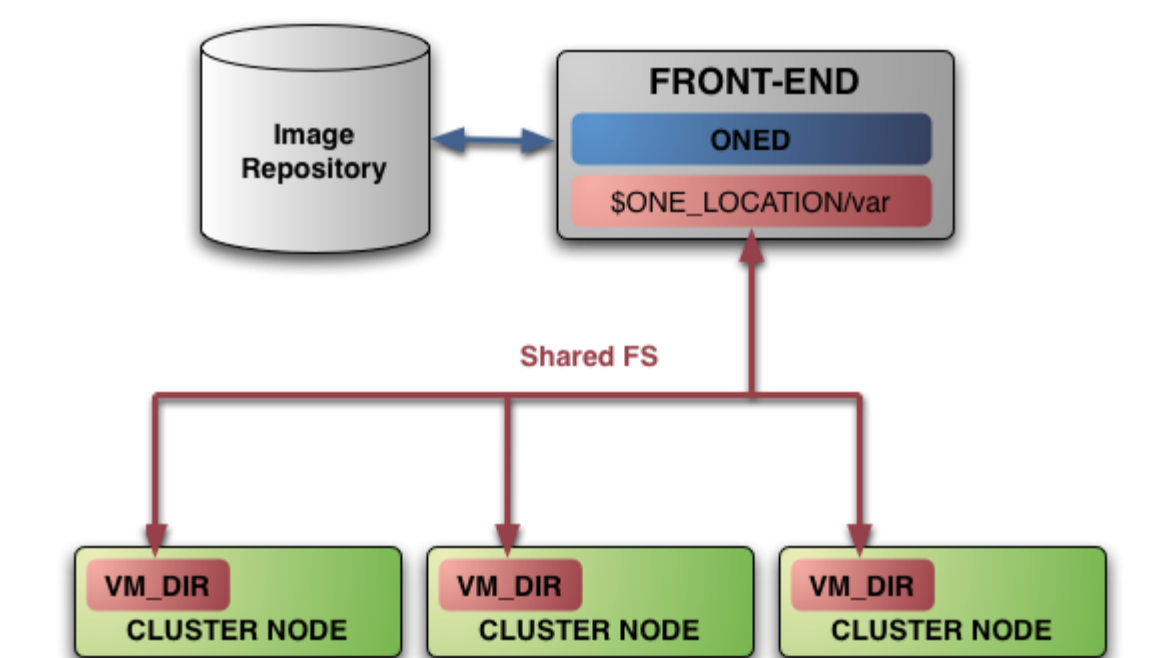


## Conclusions

We were asked to investigate open source solutions to cloud computing using virtualization. Coming from little to no background in virtualization, we encountered many problems in getting this software set up and running correctly; however, we learned a lot from our mistakes. Given a short period of time we were able to bring up a fully functional private cloud. The open source software we used is as capable as proprietary equivalents. It is developing at a rapid pace and remains a competitive solution. There is great potential for virtualization of the HPC space as more functionality is added each release; however, it's not capable of solving all of HPC's capability needs at this time.



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